CERN/LEPC 99-9
LEPC 53
12 November 1999

LEP EXPERIMENTS COMMITTEE

Minutes of the 53rd meeting,
9 November 1999

OPEN SESSION

1. Status and performance of LEP

A. Butterworth reported on the status and performance of LEP in 1999. This has been a very successful year, with LEP routinely operating at a beam energy of 101 GeV in the last few weeks of the run. With the 102/90 optics, the peak luminosities were 1.0×10^{32} $cm^{-2}s^{-1}$ at 98 GeV and 0.8×10^{32} $cm^{-2}s^{-1}$ at 100 and 101 GeV, and the peak total currents were 6.4 mA (98 GeV), 5.4 mA (100 GeV) and 4.8 mA (101 GeV). Beam-beam tune shifts as high as 0.083 have been achieved. The average luminosities per day at each energy were 2 pb^{-1} (98 GeV), 1.4 pb^{-1} (100 GeV) and 1.3 pb^{-1} (101 GeV). A total integrated luminosity per experiment of 254 pb^{-1} was delivered, including 4.2 pb^{-1} of Z calibration data. On the last day of the run, a successful test of colliding beams at 102 GeV resulted in an integrated luminosity of 10 nb^{-1}.

During operation at 101 GeV, an rf accelerating voltage averaging about 3480 MV was available from the full system of 272 Nb/Cu sc cavities (3255 MV), 16 Nb sc cavities (110 MV) and 48 Cu cavities (115 MV). The Nb/Cu cavities are currently operating at 7 MV/m mean gradient (to be compared with their design value of 6 MV/m). This rf voltage was just below the level that provides 2 klystrons reserve at 101 GeV (3490 MV), which resulted in shorter fills at the higher energies; the average fill times for physics were 2h41 (98 GeV), 2h05 (100 GeV) and 1h38 (101 GeV) [note that the optimal fill time is about 2h30].

A water leak into the LEP1 cryogenics plant at Point 4 caused a 10-day stop at the end of September. With the repair of this leak presently underway and new turbines being installed in Points 4 and 6, the full 12 kW cryogenic capacity should be available in 2000, which is sufficient for operation up to 103 GeV. Other improvements to LEP during the present shutdown include installation of a further 8 Cu cavities, adding 15-20 MV rf voltage. Meanwhile optimisation and processing continues on the existing rf cavities. In addition, 85 horizontal correctors are being converted into ring dipoles in order to increase the bending length at LEP (thereby gaining about 0.2 GeV per beam). With these improvements it is hoped that LEP operation at 101 GeV will be stable and, as the machine is further optimised during the 2000 run, that the energy can be gradually increased.

2. LEP detector reports

OPAL	P. Ward
ALEPH	A. Blondel
DELPHI	J. Marco
L3	G. Rahal-Callot

The four experiments reported good overall background conditions and high data collection efficiencies of 91-95%, which have resulted in recorded data samples of about 230 pb^{-1} in 1999 - the highest of any year. Several anomalies were reported in the new data, but so far none is beyond a possible statistical fluctuation. One example is an apparent excess of candidate SM Higgs events that appeared near a mass of 105 GeV in ALEPH data recorded at $\sqrt{s}$ = 200 GeV; no excess, however, subsequently appeared at 202 GeV. Another apparent excess of events was reported by DELPHI in the eeqq final state (where the qq mass is consistent with the Z) for the ee mass range 50-56 GeV. The SM Higgs exclusion limit per experiment is now about 106 GeV

(95% CL). Improvements of between 3 and 6 GeV were reported on the mass limits for new particles, compared with data obtained in 1998.

All experiments requested that LEP be operated at the highest energy in 2000, while maintaining a good integrated luminosity. The mini-ramp scheme was successfully demonstrated to be compatible with continuous data-taking by the detectors, providing an important new technique for reaching the highest possible energies.

CLOSED SESSION

Present: R. Cashmore, J. Colas, M. Delfino, M. Doser, T. Gaisser, V.G. Goggi, K. Hübner, P.O. Hulth, N. Harnew, P. Janot, L. Jonsson, J. Kirkby (secretary), K.-H. Kissler, W. Lohmann, M. Mangano, C. Matteuzzi, , R. Miquel, T Müller, S. Myers, D. Schaile, A. Smith, M. Spiro (chairman), R. Tenchini, A. Watson.

Apologies: F. Gasparini, J. May, Y. Sirois.

1. Discussion and recommendation on the CosmoLEP proposal

Following the reports from the referees, Alan Watson and Tom Gaisser, the committee had an extensive discussion on the CosmoLEP proposal. The committee considers the physics addressed by CosmoLEP to be interesting, namely a) to measure the nuclear composition in the energy range of the knee, 10^{15} - 10^{16} eV, and b) to obtain a better understanding of the interactions in the atmosphere of cosmic rays at these energies (which will sharpen the Monte Carlo predictions for this and other cosmic ray experiments). CosmoLEP proposes to address these questions with a novel approach, namely to measure the lateral distribution of muons above about 70 GeV, corresponding to the energy cutoff at a depth of 140 m. The expectation is that the shower core density of these muons is essentially independent of the type of primary nucleus - it depends only on the energy - and that the lateral distribution discriminates between different nuclei (with heavier nuclei producing wider showers). This discriminant appears to be relatively insensitive to the Monte Carlo models, but this needs confirming.

However the committee considers that the timescale for CosmoLEP is too constrained. ALEPH has a major repair scheduled for the TPC in the 1999-2000 shutdown. This implies that CosmoLEP could be operated for only about 6 months at best before LEP shutdown, which would limit the statistics for the shower core within the detector array to about 500 events above 3×10^{15} eV and 50 events above 10^{16} eV. Furthermore the case for combining the ALEPH detector with CosmoLEP is considered rather weak since ALEPH is too far away from the muon chamber array and has only a small livetime (about 10%) available for CosmoLEP during LEP operation.

Therefore the committee does not recommend approval of the CosmoLEP experiment as proposed. However the committee considers that both the physics and the basic experimental concept are attractive and that these ideas could be developed further.

2. Approval of the minutes of the 52nd meeting

The minutes of the 52nd meeting (LEPC 99-6/LEPC 52) were approved after the following modification. Halfway down p.2, the previous text that reads, "…most experiments expect to complete their full analysis by the end of 2003, although OPAL foresees analysis continuing until 2006", is replaced by, "…all experiments expect to complete their main analysis by the end of 2003, and foresee further analysis continuing until 2006".

3. Chairman's report

The chairman was pleased to acknowledge the support of the Research Board in extending the LEP run over the two-week reserve. The excellent luminosity obtained in this period, 20 pb^{-1}, had doubled the integrated luminosity at 101 GeV, since the authorisation from the French authorities to exceed 100 GeV was received only by the end of September. Concerning the LEP2 Monte Carlo working group, a report has been received from its chairman, R. Pittau, indicating that the group plans to complete its work and prepare a yellow report by May 2000. Finally, the chairman explained that the LEP symposium dates in October/November 2000 could not yet be finalised since they await the confirmation of the external guests.

4. Discussion on the LEP machine report

The chairman joined with the committee in warmly congratulating the machine team for the superb performance of LEP in 1999, echoing the extended applause given in the open session. Once again LEP has broken its own records for integrated luminosity (254 pb^{-1}) and peak operating energy (101 GeV), with the superconducting rf system performing well beyond its design specifications. The committee was pleased to hear that the delivered luminosities were well balanced between the four experiments (within ±2%) and that the background conditions were excellent.

5. Discussion on the LEP detector reports

The committee congratulated the LEP experiments for their high data-taking efficiency and for their fast initial analyses of the data. The way in which preliminary data is openly shared displays the fine spirit of a unified LEP community that has emerged in the effort to obtain the best possible results from LEP. Since any hints of new physics are likely to first appear in more than one experiment, this spirit of openness is of special importance in the final year of LEP operation. Although several intriguing deviations have been seen in the new data, none so far appears to be confirmed. The committee anticipates with great interest the LEP2 physics jamboree at its next meeting in March and the combined LEP results from the working groups.

6. Report from the LEP coordinator

The LEP coordinator reported that there were 153 days for physics in 1999, with an extra 23 days lost due to various problems. A total luminosity per experiment of 254 pb^{-1} was delivered, comprising the following luminosities at each energy: 4.2 pb^{-1} (45.6 GeV), 31 pb^{-1} (96 GeV), 87 pb^{-1} (98 GeV), 90 pb^{-1} (100 GeV), 42 pb^{-1} (101 GeV) and 0.01 pb^{-1} (102 GeV). The background conditions were excellent and all detectors had operated with high efficiency, collecting on average 92% of the delivered luminosity. The ten-day stop due to the water leak in the cryogenics plant was put to good use with beam calibration runs and with 1 pb^{-1} extra Z calibration data requested by L3.

The beam energy spectrometer was fully commissioned by late August and substantial data were taken over the last two months at depolarisation energies and in subsequent ramps to high energy. Analysis and systematic studies are underway with the aim to reach a precision on the LEP2 beam energy of ±10 MeV. Analysis also continues on the new Q_s vs. rf method, to try to reduce its present uncertainty of ±20 MeV.

Combining the beam requests of the four experiments for 2000, the LEP coordinator proposed a total luminosity goal of about 200 pb^{-1} at high energy, of which about 40 pb^{-1} should be devoted to achieving the very highest possible energy. In addition to the high-energy running, there would be 2.5 pb^{-1} Z calibration data at the start of the run and 0.5 pb^{-1} near the end of the run. This beam schedule is fully supported by the committee, with the ultimate energy reached either in steps as done this year or with the mini-ramp scheme, to be decided by the machine team.

7. Any other business

The chairman announced that Chamonix X workshop will take place between 17 and 21 January 2000.

8. Next LEPC meeting

The date of the next meeting of the LEPC is **Tuesday, 7 March 2000**, where a physics jamboree of LEP200 results will be held (this is a further revision of the date announced previously). The dates for the LEPC in the remainder of 2000 are

	20	July	(combined search results)
	16 - 18	October	(LEP symposium)
or	13 - 15	November	(LEP symposium)

The special meeting on 20 July will include presentations of the combined data from the four experiments in order to allow a timely recommendation for any extension of LEP beyond the planned shutdown date in September 2000. The final LEPC meeting in 2000 will coincide with a 3-day symposium planned to celebrate LEP (for which the dates are not yet finalised - see item 3 in the closed session).

J. Kirkby

DOCUMENTS RECEIVED

[1] ALEPH Collaboration, Cohabitation of ALEPH and CosmoLEP, LEPC 99-10/R15.

[2] K. Eggert, CosmoLEP, LEPC 99-11/R16.